

## General Description

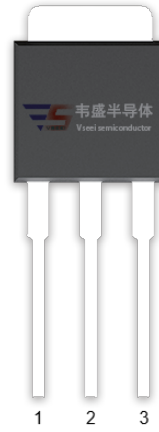
The series of devices use advanced trench gate super junction technology and design to provide excellent  $R_{DS(ON)}$  with low gate charge. This super junction MOSFET fits the industry's AC-DC SMPS requirements for PFC, AC/DC power conversion, and industrial power applications.

## Features

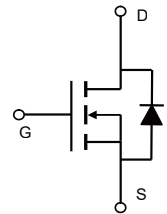
- New technology for high voltage device
- Low on-resistance and low conduction losses
- Small package
- Ultra Low Gate Charge cause lower driving requirements
- 100% Avalanche Tested
- ROHS compliant

## Application

- Power factor correction (PFC)
- Switched mode power supplies(SMPS)
- Uninterruptible Power Supply (UPS)



TO-251



Schematic

| Parameter                                                                        | Symbol          | Value    | Unit          |
|----------------------------------------------------------------------------------|-----------------|----------|---------------|
| Drain-Source Voltage ( $V_{GS}=0V$ )                                             | $V_{DS}$        | 700      | V             |
| Gate-Source Voltage ( $V_{DS}=0V$ ), AC ( $f>1$ Hz)                              | $V_{GS}$        | $\pm 30$ | V             |
| Continuous Drain Current at $T_c=25^\circ C$                                     | $I_{D(DC)}$     | 4        | A             |
| Continuous Drain Current at $T_c=100^\circ C$                                    | $I_{D(DC)}$     | 2.5      | A             |
| Pulsed drain current <sup>(Note 1)</sup>                                         | $I_{DM(pluse)}$ | 16       | A             |
| Maximum Power Dissipation( $T_c=25^\circ C$ )                                    | $P_D$           | 41       | W             |
| Derate above $25^\circ C$                                                        |                 | 0.328    | W/ $^\circ C$ |
| Single pulse avalanche energy <sup>(Note2)</sup>                                 | EAS             | 27       | mJ            |
| Avalanche current <sup>(Note 1)</sup>                                            | $I_{AR}$        | 0.7      | A             |
| Repetitive Avalanche energy , $t_{AR}$ limited by $T_{jmax}$ <sup>(Note 1)</sup> | $E_{AR}$        | 0.1      | mJ            |

| Parameter                                                        | Symbol         | Value      | Unit |
|------------------------------------------------------------------|----------------|------------|------|
| Drain Source voltage slope, $V_{DS} \leq 480\text{ V}$ ,         | $dv/dt$        | 50         | V/ns |
| Reverse diode $dv/dt$ , $V_{DS} \leq 480\text{ V}, I_{SD} < I_D$ | $dv/dt$        | 15         | V/ns |
| Operating Junction and Storage Temperature Range                 | $T_J, T_{STG}$ | -55...+150 | °C   |

**Table 2. Thermal Characteristic**

| Parameter                                         | Symbol     | Value | Unit  |
|---------------------------------------------------|------------|-------|-------|
| Thermal Resistance, Junction-to-Case (Maximum)    | $R_{thJC}$ | 3.0   | °C /W |
| Thermal Resistance, Junction-to-Ambient (Maximum) | $R_{thJA}$ | 62    | °C /W |

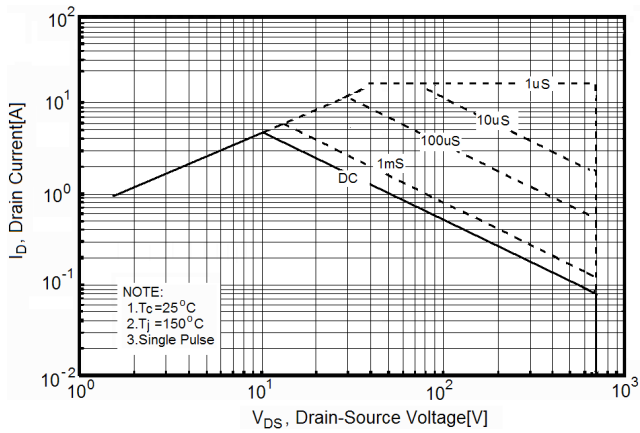
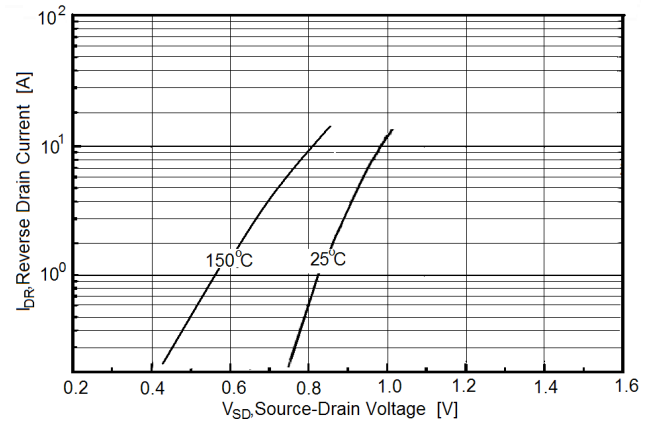
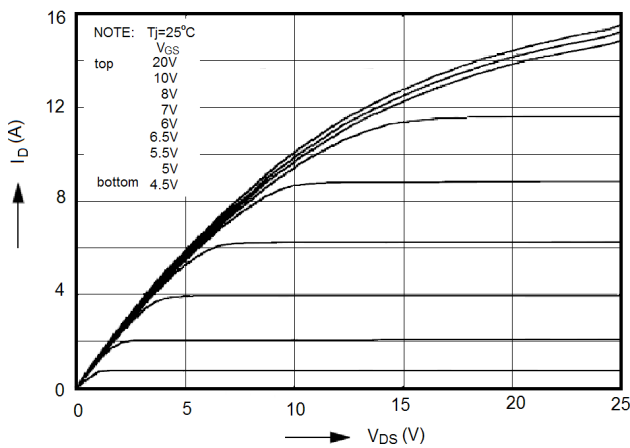
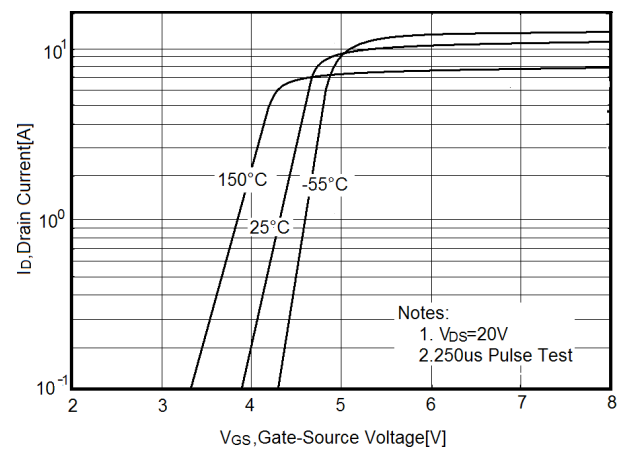
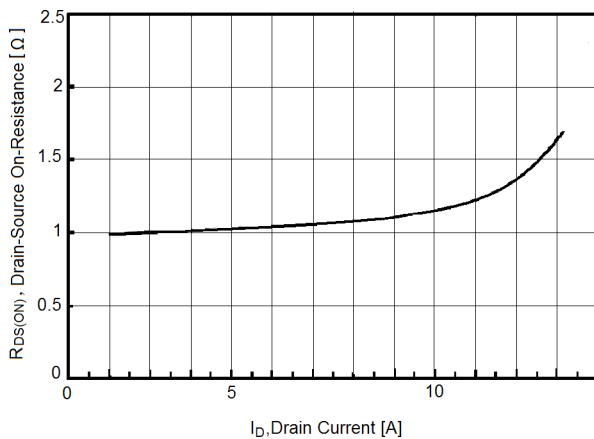
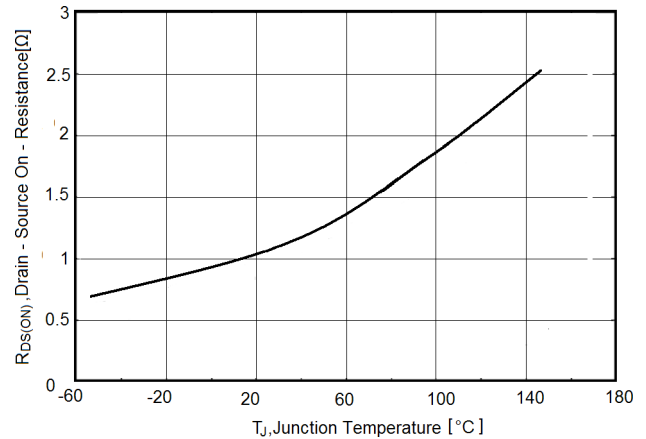
**Table 3. Electrical Characteristics (TA=25°C unless otherwise noted)**

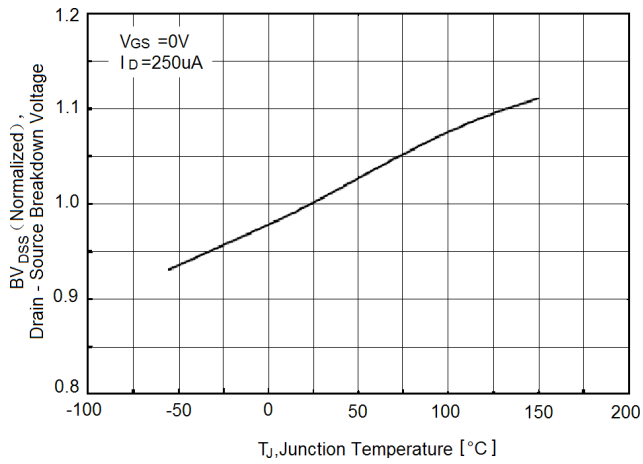
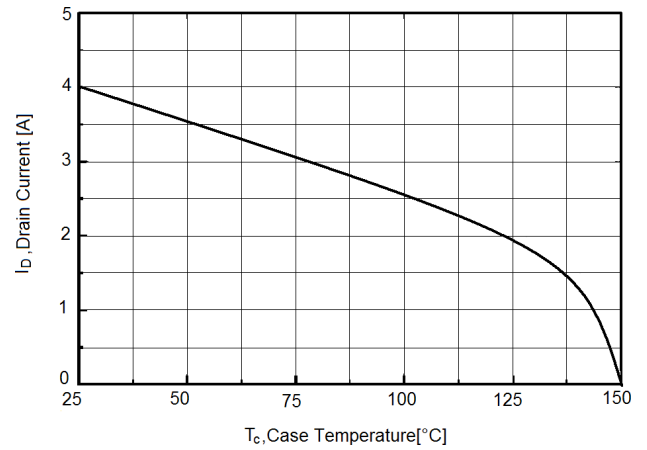
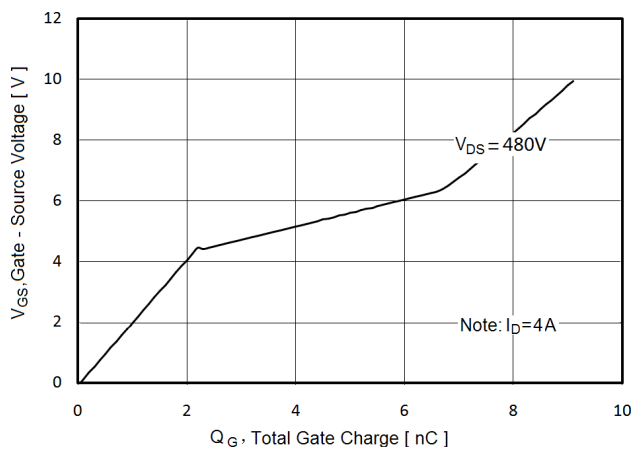
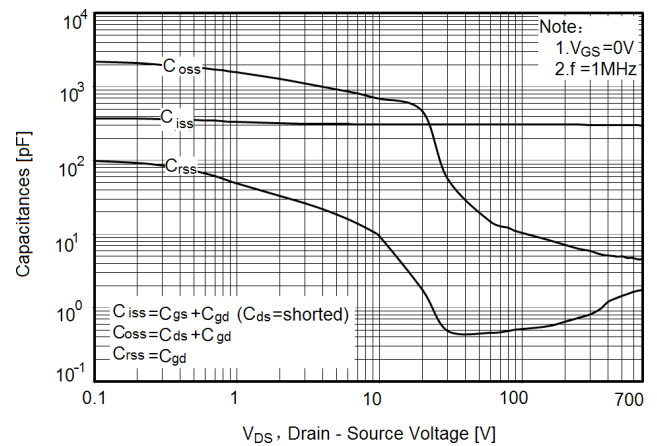
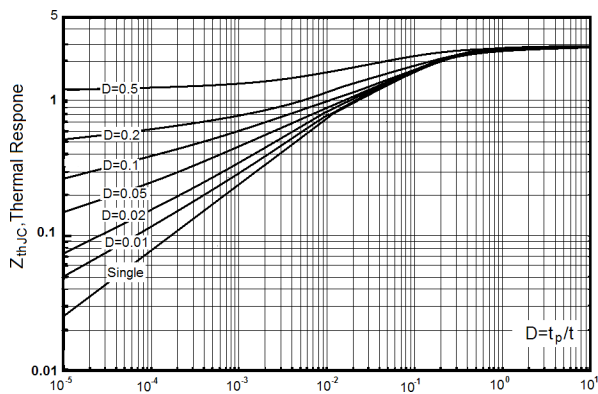
| Parameter                                | Symbol              | Condition                                                                                | Min | Typ  | Max  | Unit |
|------------------------------------------|---------------------|------------------------------------------------------------------------------------------|-----|------|------|------|
| On/off states                            |                     |                                                                                          |     |      |      |      |
| Drain-Source Breakdown Voltage           | BV <sub>DSS</sub>   | V <sub>GS</sub> =0V I <sub>D</sub> =250μA                                                | 700 |      |      | V    |
| Zero Gate Voltage Drain Current(Tc=25℃)  | I <sub>DSS</sub>    | V <sub>DS</sub> =700V, V <sub>GS</sub> =0V                                               |     |      | 1    | μA   |
| Zero Gate Voltage Drain Current(Tc=125℃) | I <sub>DSS</sub>    | V <sub>DS</sub> =700V, V <sub>GS</sub> =0V                                               |     |      | 50   | μA   |
| Gate-Body Leakage Current                | I <sub>GSS</sub>    | V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V                                               |     |      | ±100 | nA   |
| Gate Threshold Voltage                   | V <sub>GS(th)</sub> | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA                                 | 3   |      | 4    | V    |
| Drain-Source On-State Resistance         | R <sub>DS(ON)</sub> | V <sub>GS</sub> =10V, I <sub>D</sub> =2A                                                 |     | 1100 | 1300 | mΩ   |
| Dynamic Characteristics                  |                     |                                                                                          |     |      |      |      |
| Input Capacitance                        | C <sub>iss</sub>    | V <sub>DS</sub> =50V, V <sub>GS</sub> =0V,<br>F=1.0MHz                                   |     | 304  |      | PF   |
| Output Capacitance                       | C <sub>oss</sub>    |                                                                                          |     | 17   |      | PF   |
| Reverse Transfer Capacitance             | C <sub>rss</sub>    |                                                                                          |     | 0.5  |      | PF   |
| Total Gate Charge                        | Q <sub>g</sub>      | V <sub>DS</sub> =480V, I <sub>D</sub> =4A,<br>V <sub>GS</sub> =10V                       |     | 8.8  | 12   | nC   |
| Gate-Source Charge                       | Q <sub>gs</sub>     |                                                                                          |     | 2.3  |      | nC   |
| Gate-Drain Charge                        | Q <sub>gd</sub>     |                                                                                          |     | 4    |      | nC   |
| Switching times                          |                     |                                                                                          |     |      |      |      |
| Turn-on Delay Time                       | t <sub>d(on)</sub>  | V <sub>DD</sub> =380V, I <sub>D</sub> =2.5A,<br>R <sub>G</sub> =5Ω, V <sub>GS</sub> =10V |     | 8    |      | nS   |
| Turn-on Rise Time                        | t <sub>r</sub>      |                                                                                          |     | 4    |      | nS   |
| Turn-Off Delay Time                      | t <sub>d(off)</sub> |                                                                                          |     | 52   | 70   | nS   |
| Turn-Off Fall Time                       | t <sub>f</sub>      |                                                                                          |     | 9    | 18   | nS   |
| Source- Drain Diode Characteristics      |                     |                                                                                          |     |      |      |      |
| Source-drain current(Body Diode)         | I <sub>SD</sub>     | T <sub>C</sub> =25℃                                                                      |     |      | 4    | A    |
| Pulsed Source-drain current(Body Diode)  | I <sub>SDM</sub>    |                                                                                          |     |      | 16   | A    |
| Forward On Voltage                       | V <sub>SD</sub>     | T <sub>j</sub> =25℃, I <sub>SD</sub> =4A, V <sub>GS</sub> =0V                            |     | 0.9  | 1.2  | V    |
| Reverse Recovery Time                    | t <sub>rr</sub>     | T <sub>j</sub> =25℃, I <sub>F</sub> =2A, di/dt=100A/μs                                   |     | 200  |      | nS   |
| Reverse Recovery Charge                  | Q <sub>rr</sub>     |                                                                                          |     | 0.6  |      | uC   |
| Peak reverse recovery current            | I <sub>rrm</sub>    |                                                                                          |     | 6    |      | A    |

Notes: 1.Repetitive Rating: Pulse width limited by maximum junction temperature

2.  $T_J=25^\circ C, V_{DD}=50V, V_G=10V, R_G=25\Omega$

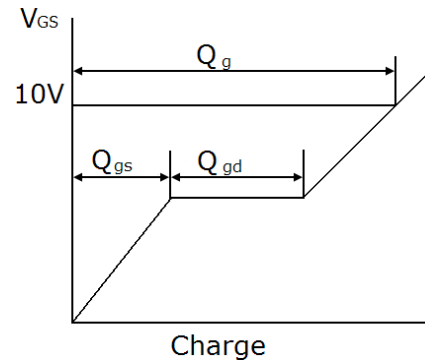
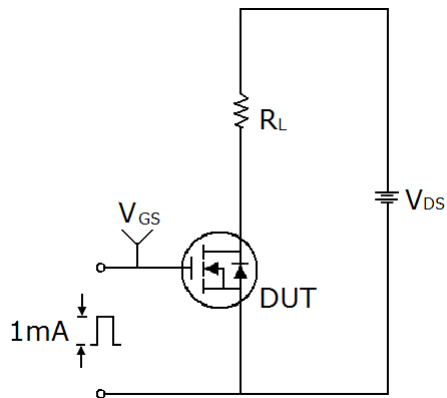
## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (curves)

**Figure1. Safe operating area**

**Figure2. Source-Drain Diode Forward Voltage**

**Figure3. Output characteristics**

**Figure4. Transfer characteristics**

**Figure5. Static drain-source on resistance**

**Figure6.  $R_{DS(ON)}$  vs Junction Temperature**


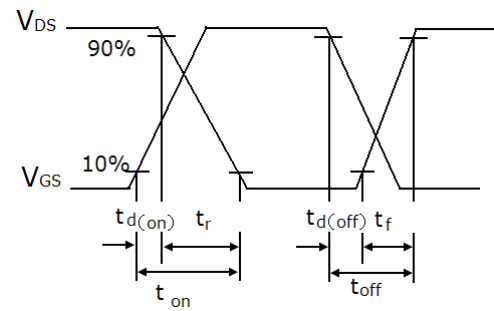
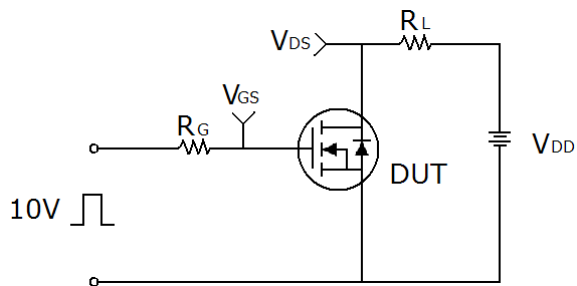
**Figure7.  $BV_{DSS}$  vs Junction Temperature**

**Figure8. Maximum  $I_D$  vs Junction Temperature**

**Figure9. Gate charge waveforms**

**Figure10. Capacitance**

**Figure11. Transient Thermal Impedance**


## Test circuit

### 1) Gate charge test circuit & Waveform



### 2) Switch Time Test Circuit:



### 3) Unclamped Inductive Switching Test Circuit & Waveforms

